



2012 Minerals Yearbook

TUNGSTEN

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In 2012, one U.S. tungsten operation produced and shipped ore concentrates. Most of the U.S. supply of tungsten raw materials comprised imports, scrap, and sales from the National Defense Stockpile (NDS). China continued to be the world's leading producer of tungsten concentrates and the leading supplier of tungsten imports to the United States. U.S. apparent consumption decreased in 2012, as compared with that of 2011. World production of tungsten concentrates increased from that of 2011, primarily because of an increase in production from China (table 15). Salient U.S. tungsten statistics and world tungsten concentrate production for 2008–12 are listed in table 1.

Most data in this report have been rounded to three significant digits. Totals and percentages were calculated from unrounded numbers. Unless otherwise specified, all statistics in this report are in metric tons of contained tungsten. Most tungsten prices and many tungsten statistics from other sources are quoted in units of tungsten trioxide (WO_3). The short ton unit, which is used in the United States, is 1% of a short ton (20 pounds), and WO_3 is 79.3% tungsten by weight. A short ton unit of WO_3 , therefore, equals 20 pounds of WO_3 and contains 7.19 kilograms (kg) (15.86 pounds) of tungsten. The metric ton unit, which is used in most other countries, is 1% of a metric ton (10 kg). A metric ton unit of WO_3 , therefore, equals 10 kg of WO_3 and contains 7.93 kg (17.48 pounds) of tungsten.

Tungsten is a whitish-gray metal with many unique properties and a wide variety of commercial, industrial, and military applications. The leading use is as tungsten carbide in cemented carbides, which are wear-resistant materials used by the construction, metalworking, mining, and oil and gas drilling industries. Pure or doped tungsten metal contacts, electrodes, and wires are used in electrical, electronic, heating, lighting, and welding applications. Tungsten is also used to make alloys and composites to substitute for lead in ammunition and other products; heavy-metal alloys for armaments, heat sinks, radiation shielding, and weights and counterweights; superalloys for turbine engine parts; tool steels; and wear-resistant alloy parts and coatings. Tungsten chemicals are used to make catalysts, corrosion-resistant coatings, dyes and pigments, fire-resistant compounds, lubricants, phosphors, and semiconductors.

Legislation and Government Programs

During fiscal year 2012 (October 1, 2011, through September 30, 2012), DLA Strategic Materials (DLA), U.S. Department of Defense, sold 1,650 metric tons (t) of contained tungsten. At the end of the fiscal year, 533 t of committed tungsten in ores and concentrates and 4 t of committed tungsten metal powder had not yet been shipped. During the calendar year, DLA sold 1,820 t of tungsten. The quantities of uncommitted tungsten materials remaining in the stockpile at the end of the calendar year are listed in tables 1 and 2.

The 2011 Biennial Report on Stockpile Requirements listed tungsten ores and concentrates as a required material with an NDS inventory greater than the amount needed and tungsten metal powder as a material that was not required in the NDS (U.S. Department of Defense, 2013, p. 4, 8).

The Annual Materials Plan (AMP) for fiscal year 2012, which represented the maximum quantities of tungsten materials that could be sold, is listed in table 2. The quantities of tungsten available for sale during fiscal year 2013 (October 1, 2012, through September 30, 2013) were reduced to 2,300 t of tungsten contained in ores and concentrates and 35 t of tungsten metal powder (DLA Strategic Materials, 2012).

The Governments of the United States, the European Union, and Japan requested and held formal consultations with the People's Republic of China at the World Trade Organization (WTO) concerning China's export restraints on various forms of molybdenum, rare earth metals, and tungsten. When this did not resolve the matter, the WTO established a dispute settlement panel. The dispute had not been resolved by yearend (Office of the United States Trade Representative, undated).

The U.S. Securities and Exchange Commission (SEC) established final rules for the implementation of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, which related to the use of minerals determined to be financing conflict in Congo (Kinshasa) or an adjoining country. Section 1502 required companies for which conflict minerals were necessary to the functionality or manufacture of their products to disclose annually whether any of those minerals originated in Congo (Kinshasa) or an adjoining country. Wolframite, one of two principal minerals mined for tungsten, was included in the list of conflict minerals (U.S. Securities and Exchange Commission, 2012, p. 56274–56275). In response to the Act, a number of tungsten processors, in conjunction with the International Tungsten Industry Association and the Refractory Metals Association, worked to establish the Tungsten Industry–Conflict Minerals Council (TI–CMC). The TI–CMC planned to create a framework to provide assurances that tungsten products originating from TI–CMC compliant companies were conflict free (Tungsten Industry–Conflict Minerals Council, undated). Tungsten mine production from Congo (Kinshasa) and adjoining countries is typically less than 4% of world production (table 15).

Production

Domestic production statistics for tungsten are based on data collected by the U.S. Geological Survey (USGS) by means of two separate voluntary surveys. Statistics that result from these surveys are listed in tables 1 and 3. The annual “Tungsten Ore and Concentrate Survey” covered the production, purchase, disposition, and stocks of tungsten ores and concentrates. In

2012, Curtis Tungsten, Inc. (Upland, CA) produced and shipped scheelite concentrates from the Andrew Mine northeast of Los Angeles, CA.

EMC Metals Corp. (Vancouver, British Columbia, Canada) canceled the sale of its Springer complex in Pershing County, NV, and worked on a plan to restart production there. The complex comprised an underground scheelite mine, a beneficiation plant, and a processing circuit designed to produce either ammonium paratungstate (APT) or calcium tungstate (also known as synthetic scheelite). Although on care-and-maintenance status since 1982, investments had been made to the facilities in recent years. A preliminary economic analysis on Springer indicated that approximately 1,070 metric tons per year (t/yr) of tungsten in scheelite concentrate could be produced during a 5-year mine life based on indicated and inferred resources on the property, with production beginning in late 2013 or early 2014 (EMC Metals Corp., 2012, p. 14–17).

The USGS monthly “Tungsten Concentrate and Tungsten Products Survey” canvassed companies that produced tungsten carbide powder, tungsten chemicals, and (or) tungsten metal powder from APT, tungsten-bearing scrap, and tungsten concentrate. U.S. processors of tungsten materials operating in 2012 are listed in table 4.

In 2012, U.S. processors consumed less tungsten concentrates, APT, and scrap than they did in 2011. Domestic production of APT was lower than that of 2011. Total net production of tungsten metal powder and tungsten carbide powder decreased by 18% in 2012 compared with that of 2011 (table 3).

Niagara Refining LLC (a subsidiary of Buffalo Tungsten Inc.) was constructing a plant in Depew, NY, to convert tungsten concentrates to APT and tungsten oxides. The plant was permitted to produce a combined total of approximately 2,500 t/yr (2,750 short tons per year) of APT and oxide. Production was to begin in early 2014 (New York State Department of Environmental Conservation, 2012, p. 1, 22; Sumitomo Electric Industries, Ltd., 2013).

Kennametal Inc. (Latrobe, PA) announced plans to build an advanced recycling facility in the United States for reclaiming material from used cemented carbide parts, such as metal-cutting inserts (Kennametal Inc., 2012).

Consumption

U.S. apparent consumption of all tungsten materials, as calculated from net imports, secondary production, and changes in Government and industry stock levels, was 15,000 t in 2012, 17% lower than the 2011 apparent consumption of 18,100 t. Primary U.S. production was not available to include in the calculation. The decrease in apparent consumption in 2012 was mainly the result of lower scrap consumption and lower net imports compared with those of 2011.

Statistics on consumption of tungsten in end-use applications by U.S. metal consumers were developed from the voluntary “Consolidated Consumers Survey.” For this survey, more than 50 tungsten consumers were canvassed on a monthly or annual basis. Reported consumption and stocks data in tables 1 and 5 include estimates to account for nonrespondents.

Total U.S. reported consumption of tungsten materials to make end-use products in 2012 was 7% lower than that of 2011. Consumption to make mill products and superalloys was lower than that of 2011; consumption to make cemented carbides, steel, and other alloys was higher than that of 2011. Compared with consumption in 2011, U.S. end users consumed less tungsten metal powder and tungsten scrap, and more ferrotungsten and tungsten carbide powder. Estimated consumption of tungsten compounds in chemical applications remained unchanged.

Weekly reports of the number of operating drilling rigs give an indication of the demand for tungsten carbide in the form of cemented carbide components used by industry to explore for or produce oil and natural gas. Although the number of rigs operating each week in the United States trended downward during 2012, the average number of weekly operating rigs in 2012 was slightly higher than the average number of operating rigs in 2011 (1,919 in 2012 as compared with 1,879 in 2011) (Baker Hughes Inc., undated).

In 2012, total consumption of tungsten scrap by U.S. processors and consumers was 8,190 t of contained tungsten, which was 14% less than the 9,560 t consumed in 2011.

Prices

The weekly U.S. spot tungsten ore concentrate price reported by Platts Metals Week and Platts Metals Daily remained unchanged during the year at \$320 to \$330 per short ton unit (\$353 to \$364 per metric ton unit). The annual average of Platts’ tungsten ore concentrate prices was 44% greater than that of 2011 (table 1). The semiweekly tungsten ore price reported by Metal Bulletin, which had remained unchanged since late 2008, was discontinued in October 2012.

The weekly U.S. APT price reported by Platts remained unchanged during the year at \$395 to \$420 per short ton unit (\$435 to \$463 per metric ton unit). The annual average of Platts’ U.S. APT prices was 13% greater than that of 2011. U.S. APT prices reported by Metal Bulletin decreased during the first 5 months of the year, increased in late May, and then remained stable until mid-July, when they were discontinued. Between January and mid-July, they ranged between \$370 and \$430 per short ton unit (\$408 to \$474 per metric ton unit).

In 2012, Platts’ ferrotungsten price increased and then decreased; it ranged from a low of \$42.00 per kilogram of contained tungsten to a high of \$59.50 per kilogram of contained tungsten. The annual average price, at \$50.18 per kilogram of contained tungsten, was slightly less than the annual average of \$51.18 per kilogram of contained tungsten in 2011.

Foreign Trade

The tungsten content of U.S. exports was 6,730 t, 6% less than the 7,130 t exported in 2011 (tables 6–10). The tungsten content of U.S. imports was 11,700 t, 12% less than the 13,200 t imported in 2011. China, which continued to be the leading supplier of imported tungsten to the United States, provided 41% of all tungsten imports in 2012. The tungsten content of imports from China decreased by 15% to 4,820 t in 2012, from 5,690 t in 2011. The distribution of materials imported from

China was as follows: APT, 29%; tungsten oxide, 24%; tungsten carbide powder, 17%; wrought tungsten, 11%; tungsten metal powders and unwrought tungsten, 7% each; ferrotungsten, 3%; tungsten waste and scrap, 1%; other tungstates and tungsten ores and concentrates, 0.3% each. Other significant suppliers of tungsten materials to the United States were as follows: Bolivia, 10%; Germany and Portugal, 6% each; Canada, 5%; and the Republic of Korea, 4%.

The tungsten contained in U.S. imports of ores and concentrates was slightly higher than that of 2011 (table 11). In 2012, the leading suppliers of U.S. imports of tungsten ores and concentrates were Bolivia (32%), Portugal (18%), Spain (15%), Canada (9%), and Peru (8%).

U.S. imports of APT were 26% lower than those of 2011 (table 12). China continued to be the dominant supplier, providing 94% of U.S. APT imports. Imports of other tungsten materials are presented in tables 13 and 14.

Net import reliance as a percentage of apparent consumption is used to measure the adequacy of current domestic production to meet U.S. demand. Net import reliance was defined as imports minus exports plus adjustments for Government and industry stock changes. Releases from stocks, including shipments from the NDS, were counted as part of import reliance, regardless of whether they were imported or produced in the United States. In 2012, U.S. net import reliance for tungsten as a percentage of apparent consumption was 43%, because of the significant amount of tungsten consumed from scrap.

World Review

Estimated world tungsten mine production increased slightly from that of 2011, primarily because of an increase in production from China (table 15). In addition to mine production and tungsten recovered from scrap, tungsten materials from the NDS contributed to supply in 2012.

Australia.—Tasmania Mines Ltd. (Sydney) produced a small amount of scheelite concentrate from its Kara open pit magnetite mine south of Burnie in Tasmania.

Deutsche Rohstoff AG [(DRAG) Heidelberg, Germany] produced tungsten and molybdenum concentrates from its Wolfram Camp open pit mine and beneficiation plant west of Cairns, Queensland. During the year, DRAG decided to upgrade the plant to increase throughput and metal recovery rates, so that production forecasts could be met with lower than expected ore grades. Wolframite concentrate from Wolfram Camp was committed to U.S. tungsten processor Global Tungsten & Powders Corp. (GTP) under a 5-year offtake agreement (Deutsche Rohstoff AG, 2012).

Carbine Tungsten Ltd. (Sydney) was developing its Mt. Carbine tungsten mine west of Port Douglas in northern Queensland in three stages. In 2012, Carbine began processing tailings generated during past mining operations and sold the resulting concentrates to Mitsubishi Corporation Unimetals Ltd. (Tokyo, Japan) under an offtake agreement. Carbine completed a feasibility study on the second and third stages of production—processing low-grade stockpiled ore for 4 to 5 years and open pit mining for at least 10 years. The study forecast that production could begin in 2014 and would

average nearly 2,100 t/yr of tungsten in concentrate. Carbine announced a strategic investment by Mota-Engil Minerals & Mining Investments BV (Amsterdam, Netherlands) and received letters of intent from an international trading house and a major western tungsten producer for offtake agreements for the concentrates to be produced. By yearend, Carbine had started the initial environmental permitting and engineering for processing stockpiled ore (Carbine Tungsten Ltd., 2013, p. 2–7).

King Island Scheelite Ltd. (Sydney) completed a feasibility study on reestablishing mining and processing operations at the former King Island Scheelite Mine at Grassy, King Island, northwest of Tasmania. The company planned a 10-year operation, first retreating tailings from former mining operations, followed by underground mining from two ore bodies. At full production, 2,780 t/yr of tungsten in concentrate would be produced. The project, which had approval for development and mining, was scheduled to begin production within 24 months after receiving funding (King Island Scheelite Ltd., 2012).

Thor Mining PLC (London, United Kingdom) completed a revised feasibility study on its Molyhil tungsten-molybdenum project. The study proposed an open pit mine and beneficiation plant, to be constructed northeast of Alice Springs in the Northern Territory, which would produce 2,200 t/yr of scheelite concentrate and 1,250 t/yr of molybdenite concentrate during an initial 4-year life. During the second half of the year, Thor discussed offtake agreements and project finance with various companies and pursued opportunities for mine optimization (Thor Mining PLC, 2012, p. 2; 2013, p. 2).

Venture Minerals Ltd. (Subiaco) completed a feasibility study on its Mt. Lindsay tin-tungsten project in northwest Tasmania and shifted its focus towards the approval process and strategies for offtake agreements and financing. Venture planned to mine the ore by open pit and underground methods for a period of 9 years (Venture Minerals Ltd., 2012).

Hazelwood Resources Ltd. (Perth) continued to study the feasibility of developing the Big Hill scheelite deposit in its Cookes Creek tungsten project in northwestern Western Australia. Once in production, concentrates from Big Hill were expected to be a major source of feed for the Asia Tungsten Products Co. Ltd. ferrotungsten plant in Vietnam (Hazelwood Resources Ltd., undated).

Vital Metals Ltd. (Subiaco) continued with the feasibility study and environmental permitting for its Watershed project northwest of Cairns, Queensland. Vital was considering an open pit mining operation capable of producing approximately 1,560 t/yr of tungsten in scheelite concentrates, with an initial life of 6 years. The study was being funded by Japan Oil, Gas and Metals National Corp. (JOGMEC), which would earn a 30% interest in the project (Strizek, 2011, p. 18).

Austria.—Wolfram Bergbau und Hütten AG (owned by Sandvik AB, Sandviken, Sweden) operated the Mittersill scheelite mine and beneficiation plant in the State of Salzburg, the Bergla tungsten processing plant, and a tungsten recycling unit near St. Martin in the State of Steiermark. The Mittersill Mine supplied approximately one-half of the feed for the Bergla processing plant; the remainder was reportedly imported from Russia (40%) and Bolivia (10%). During the year, Sandvik

decided to expand the St. Martin recycling unit's capacity to process cemented carbides (Baylis, 2013, p. 11; Sandvik AB, 2013, p. 22).

Brazil.—Largo Resources Ltd. (Toronto, Ontario, Canada) ramped up production from its Currais Novos project, which reprocessed tailings generated by past production from two former tungsten-molybdenum mines west-southwest of Natal, Rio Grande do Norte State. Largo was unable to reach full production levels during the year as planned, because water shortages caused by a severe regional drought led the company to temporarily suspend production (Largo Resources Ltd., 2012).

Nosso Senhor de Bonfim reportedly restarted production at the Bonfim scheelite mine in Rio Grande do Norte State. The company planned to increase production from 250 t/yr of concentrate to 700 t/yr by yearend 2013, at which time it planned to begin producing ferrotungsten at a rate of 2,000 t/yr (Metal-Pages, 2012).

Canada.—North American Tungsten Corp. Ltd. (NATC) (Vancouver) continued to invest in capital improvements to extend the life of its Cantung Mine in the Northwest Territories and to strengthen operating performance. Production of tungsten in scheelite concentrates increased by 12%, in spite of a 2-week suspension of operations in June, owing to significant washouts on the only road to the mine. In addition, NATC continued to provide information to the Yukon Environmental and Socio-economic Assessment Board for the development of its Mactung scheelite deposit in the Yukon (North American Tungsten Corp. Ltd., 2013, p. 5–6).

Northcliff Resources Ltd. (Vancouver, British Columbia) worked on the feasibility and environmental impact assessment (EIA) studies for its wholly owned Sisson tungsten-molybdenum project in New Brunswick. Northcliff was considering an open pit mine, a beneficiation plant to produce tungsten and molybdenum concentrates, and an onsite processing plant to convert the tungsten concentrate to APT. The mine life was expected to be 27 years and APT production was expected to average approximately 5,460 t/yr of contained tungsten during the first 5 years of operation and approximately 4,420 t/yr of contained tungsten during the life of the mine. Northcliff hoped to receive EIA approvals and begin construction on the project in 2014, so that commissioning could begin in 2016 (Northcliff Resources Ltd., 2013).

China.—In 2012, China's production of concentrates increased to 64,000 t of contained tungsten. The distribution of production by Province was as follows: Jiangxi (37%); Hunan (33%); Henan (12%); Guangxi (5%); Guangdong, Inner Mongolia, and Yunnan (3% each); Fujian (2%); and Hubei (0.5%). Chinese tungsten supply (mine production plus imports) was 69,000 t, domestic consumption was 32,000 t (a decrease of 16% from that of 2011), and exports were 21,000 t (a decrease of 21% from those of 2011), which resulted in a surplus of 16,000 t (Tungsten & Molybdenum Monthly, 2013b).

Despite its position as the world's leading miner of tungsten, China has imported significant quantities of tungsten concentrates in recent years. In 2012, China imported 4,583 t of tungsten in concentrates, slightly less than it imported in 2011 (Tungsten & Molybdenum Monthly, 2013b).

China's Government maintained a program to conserve its tungsten resources and to ensure that its tungsten supply would meet anticipated demand. The program included regulating the production of tungsten concentrates through exploration and mine licenses, mine closures, and production quotas; regulating the processing of tungsten concentrates; and regulating tungsten exports by issuing export licenses, adjusting export taxes, and restricting the volumes and types of tungsten materials and products that could be exported. For 2012, the tungsten concentrate production quota was increased by 2% to 89,000 t (65% WO₃) and was divided into three parts—primary mine production, 78%; comprehensive recovery from other sources, 20%; and an amount reserved for adjustments if necessary, 2%. Chinese mine production is typically higher than the quota. For example, the 2012 quota of 89,000 t (65% WO₃) was equivalent to approximately 45,900 t of contained tungsten, but production was estimated to be 64,000 t of contained tungsten. The excess production was attributed to the many small producers that represent a significant portion of total production and on which the government policy was not well implemented. In 2012, China's export quota was reduced to 15,400 t of all tungsten products, a decrease of 2% from the quota of 15,691 t in 2011 (Fang, 2012, p. 5, 26; Tungsten & Molybdenum Monthly, 2013a).

The Ganzhou Tungsten Association issued monthly recommended prices for tungsten concentrates, APT, and tungsten carbide powder; China Minmetals issued monthly recommended prices for tungsten concentrates (Tungsten & Molybdenum Monthly, 2012).

Congo (Kinshasa).—As discussed in the “Legislation and Government Programs” section of this report, companies reporting to the U.S. Securities and Exchange Commission are subject to the conflict minerals rules in the Dodd-Frank Wall Street Reform and Consumer Protection Act with regard to tungsten exports from Congo (Kinshasa) and adjoining countries.

India.—Sandvik's 1,000-t/yr tungsten recycling plant in Chiplun operated at capacity in 2011. The company was considering tripling the plant's production capacity by the end of 2015. The plant used the zinc process to treat cemented carbide scrap (Mining Magazine, 2012).

Japan.—The Japanese Government maintained a strategy to ensure the country's supply of raw materials, including tungsten. The strategy included providing assistance to develop new mine production in other countries, increasing recycling rates, promoting research to reduce consumption by increasing the life of tungsten products or developing substitutes, and making improvements to the stockpiling program. One example of its assistance to develop new mine production was JOGMEC's involvement in the Watershed tungsten project discussed in the “Australia” section of this report (Japan Oil, Gas and Metals National Corp., 2011, p. 1–2).

Korea, Republic of.—State-run Korea Resources Corp. planned to increase its stockpile of various metals, including tungsten. The new target was to stock the equivalent of 60 days of domestic consumption by 2016 (Park, 2011).

Woulfe Mining Corp. (Vancouver, British Columbia, Canada), Sangdong Mining Corp. (Woulfe's South Korean subsidiary),

and IMC International Metalworking Companies B.V. (Gouda, Netherlands) entered into agreements for IMC to help finance the reopening of the Sangdong tungsten-molybdenum mine southeast of Seoul in Gangwon Province. The project would comprise an underground mine and a beneficiation plant that would use mineral flotation to produce scheelite concentrate, an intermediate tungsten product, and a bulk sulfide concentrate containing bismuth and molybdenum. The companies agreed to establish a joint-venture company to build an APT plant in the Republic of Korea, which would process 90% to 100% of the scheelite concentrate produced from the mine and IMC would acquire 90% to 100% of the APT produced under an offtake agreement. Mine life was expected to be 11.5 years, with an average production of approximately 4,350 dry metric tons per year of APT at a grade of 88.6% WO₃ (approximately 3,060 t/yr contained tungsten). Woulfe planned to have the mine in commercial production by late 2014 or early 2015 (Tetra Tech WEI Inc., 2012, p. 1-4, 1-6–1-7, 1-11; Woulfe Mining Corp., 2013, p. 2–3, 5).

Peru.—Malaga Inc. (Montreal, Quebec, Canada) produced tungsten concentrate from the Pasto Bueno Mine and beneficiation plant in the Ancash region. In 2012, Malaga's concentrate production decreased by 37%, owing to lower tonnage and grade of ore mined. Low ore grades resulted in reduced production of tungsten in concentrate, lower sales volumes, and higher cash cost of production, which led Malaga to place the operation on care-and-maintenance status during the fourth quarter. All concentrate from Pasto Bueno was sold to GTP under an offtake agreement (Malaga Inc., 2013, p. 5–8).

Portugal.—Sojitz Beralt Tin and Wolfram (Portugal) S.A. (Barroca Grande) produced wolframite concentrate from the Panasqueira Mine and beneficiation plant in central Portugal. Concentrate from Panasqueira was sent to Japan, the United States, and elsewhere to be processed.

Russia.—Five companies mined tungsten and produced concentrates. The companies, with the locations of their operations and listed in order of their recent share of production, were as follows: JSC A&IR Mining, which produced concentrates from ores mined by Primorsky GOK in Primorskiy Krai; KGUP Primteploenergo, which had the exploration and mining license for the Lermontov Mine in Primorskiy Krai; Russkaya Gornorudnaya Kompaniya (RGRK, the Russian Ore Mining Company), which managed JSC Novoorlovsky GOK in Zabaykal'sk Krai; Wolfram Company CJSC, which owned CJSC Buryat Wolfram in Zakamensk, Buryatiya Republic; and prospectors' cooperative Artel Quartz Ltd. (Kvarz) in Zabaykal'sk Krai. Wolfram Company (Moscow) Hydrometallurg plant at Nalchik, Kabardino-Balkariya Republic, and Kirovgradskiy Zavod Tverdykh Splavov OAO's Kirovgrad Hard Alloys plant in Sverdlovsk Oblast produced APT, tungsten anhydride, and tungsten oxide. In 2012, Wolfram Company developed a process to produce concentrate from its tailings (Gorbachev, 2013, p. 9–10).

Rwanda.—Tinco Investments Ltd. (London, United Kingdom) was investing in its Nyakabingo tungsten mine, northwest of Kigali. Tinco planned to increase production of wolfram concentrates from 35 to 40 metric tons per month to 70 metric tons per month (Tinco Investments Ltd., undated).

Spain.—Daytal Resources Spain, S.L. (a subsidiary of Almonty Industries Inc., Toronto, Ontario, Canada) worked to increase production from the Los Santos tungsten mine in Salamanca Province. During the year, the company made operational changes and improvements to the beneficiation plant, which led to higher tungsten recovery rates. Exploration resulted in an increase in reserves, which were expected to extend the mine's life to 8 years (Almonty Industries Inc., 2013, p. 5–6).

W Resources Plc (formerly Caspian Holdings Plc, London, United Kingdom) planned to produce concentrate from the La Parrilla tailings deposit in the Extremadura region in the Provinces of Badajoz and Caceres. In early 2013, the regional mining department granted approval for the project, which was to begin production during the second half of 2013 and produce at a rate of approximately 220 t/yr tungsten and 26 t/yr tin (W Resources Plc, 2013).

Ormonde Mining plc (Dublin, Ireland) completed a feasibility study of its Barruecopardo tungsten project in Salamanca Province, continued with the mine permitting process, and worked on capital funding arrangements. Barruecopardo was the leading tungsten mine in Spain until its closure in the early 1980s. Ormonde planned to mine the ore by conventional open pit methods and use gravity methods to produce scheelite concentrates containing an average of 1,800 t/yr of tungsten during the initial 9 years of operation. The company planned to begin project development in 2013 (Ormonde Mining plc, 2013, p. 2, 4–6, 50).

Sweden.—Minpro AB (Strassa) introduced a new type of ferrotungsten to the market. The product, named quick mix ferrotungsten (abbreviated FeW QM), was produced by leaching grinding sludge and spent cemented carbide tools, removing the cobalt to be sold as a byproduct, and then adding iron to the tungsten carbide. It was porous, which allowed it to dissolve more quickly in steel melts in spite of higher tungsten contents than those of ferrotungsten produced by smelting ore concentrates. Minpro's plant in Strassa had a production capacity of about 1,000 t/yr of ferrotungsten, which was estimated to be about one-third of European consumption (Advantage Environment, 2013; Metal Bulletin, 2013a, b).

United Kingdom.—Wolf Minerals Ltd. (Subiaco, Australia) worked on redeveloping the Hemerdon Mine northeast of Plymouth. The project comprised an open pit mine and beneficiation plant that was expected to produce approximately 2,700 t/yr of tungsten in wolframite concentrate and 450 t/yr of tin in concentrate for a minimum of 10 years. During the year, Wolf Minerals received key environmental approvals for the project, completed construction of a road to the property, secured funding to begin construction on the project, and signed a heads of terms offtake agreement with GTP and Wolfram Bergbau for the tungsten concentrate to be produced (Wolf Minerals Ltd., 2013).

The British Geological Survey evaluated 41 chemical elements or element groups of economic value and identified tungsten as having a very high risk of supply disruption because more than 66.6% of its production was from one country (China). In addition, tungsten was determined to have a low to medium recycling rate and a limited number of substitutes (British Geological Survey, 2012).

Uzbekistan.—Open Joint Stock Company Uzbek Refractory and Heat-resistant Metals reportedly produced 130.8 t of tungsten metal from its plant in Chirchik, Tashkent region, 2.8 times more than it produced in 2011. The tungsten was produced from raw material imported from Russia (UzDaily, 2013).

Uzbekistan-Korea Tungsten [a proposed joint venture between the State Committee of the Republic of Uzbekistan on Geology and Mineral Resources and Shindong Resources Co. Ltd. (Republic of Korea)] planned to develop the Sautbay tungsten deposit in Navoi region. In 2012, the partners agreed to prepare a feasibility study on the project. Following completion of the study in mid-2013, the joint venture would be formally established. The project entailed exploration of the deposit and construction of a mine and beneficiation plant (Journal of Turkish Weekly, The, 2012).

Vietnam.—Vietnam Youngsun Tungsten Industry Co., Ltd. reportedly shipped 2,700 t of ferrotungsten from its plant in Halong City, Quang Ninh Province. Ore from the Thien Ke tungsten mine in Tuyen Quang Province was used to produce the ferrotungsten, which was exported mainly to Europe, but also to Japan, the Republic of Korea, and the United States (Hack, 2013; Metal Bulletin, 2013c).

At yearend, Hazelwood Resources was securing feedstock from overseas suppliers for its majority-owned Asia Tungsten Products ferrotungsten plant in the Vinh Bao district near the port of Haiphong. Hazelwood Resources planned to hot commission the plant and produce the first salable ferrotungsten in the March quarter of 2013. The plant had the capacity to produce 4,000 t/yr of ferrotungsten, containing approximately 3,000 t/yr of tungsten, which was to be sold by Wogen Resources Ltd. (Hazelwood Resources Ltd., 2012).

Masan Resources Corp. (Ho Chi Minh City) continued construction of its Nui Phao project in Thai Nguyen Province. The project comprised an open pit mine and processing complex to produce fluor spar, copper concentrate, APT, and bismuth, listed in order of annual output. Masan forecast APT output during the first 5 years of full production would average approximately 4,800 t/yr of contained tungsten. The company planned to begin operating the processing plant during the second quarter of 2013 (Masan Resources Corp., 2012, p. 35–37, Masan Group Corp., 2013, p. 6).

Outlook

World tungsten supply will continue to be dominated by China's production and exports. The Chinese Ministry of Land and Resources established the total tungsten production quota for 2013 at 89,000 t (65% WO₃), equal to that of 2012. The export quota for 2013 reportedly remained unchanged from that of 2012 (Ryan's Notes, 2012; Liu, 2013, p. 7).

In the next few years, mine production from outside China is expected to increase. As discussed in the "World Review" section of this report, numerous companies worked towards developing tungsten deposits or restarting tungsten production from inactive mines in Asia, Australia, Europe, North America, and South America. The amount, location, and timing of future production will depend on the companies' ability to acquire funding. Increased production capacity for APT and

ferrotungsten outside China is also planned. Scrap will continue to be an increasingly important source of raw material for the tungsten industry worldwide.

Tungsten consumption is strongly influenced by general economic conditions. Future consumption of tungsten in cemented carbides, which is the leading end-use sector, will depend on the performance of the following industries: automotive and aircraft production; construction; electronics manufacturing, where cemented carbide microdrills are used on circuit boards; general manufacturing; large equipment manufacturing; mining; and oil and gas drilling. Tungsten use is also influenced by Government spending for defense applications.

References Cited

- Advantage Environment, 2013, Resource-efficient metal production: Stockholm, Sweden, Confederation of Swedish Enterprise, January. (Accessed May 16, 2013, at <http://advantage-environment.com/arbetsplatser/resource-efficient-metal-production/>.)
- Almonty Industries Inc., 2013, Management discussion and analysis for the three month period ended December 31, 2012: Toronto, Ontario, Canada, Almonty Industries Inc., February 13, 22 p.
- Baker Hughes Inc., [undated], North America rotary rig count (Jan 2000 – current): Baker Hughes Inc. (Accessed May 22, 2013, via <http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reports&other>.)
- Baylis, Robert, 2013, Tungsten—How China pulls the strings in unlocking potential new ROW supply: Minor Metals Trade Association International Minor Metals Conference, Washington, DC, April 24–26, presentation, 20 p.
- British Geological Survey, 2012, Risk list 2012: Nottingham, United Kingdom. (Accessed June 4, 2013, via <http://www.bgs.ac.uk/mineralsuk/statistics/riskList.html>.)
- Carbine Tungsten Ltd., 2013, Half year financial report—31 December 2012: Sydney, Australia, Carbine Tungsten Ltd., 21 p.
- Deutsche Rohstoff AG, 2012, Current state of corporate development and outlook for 2013: Heidelberg, Germany, Deutsche Rohstoff AG press release, December 19, 5 p.
- DLA Strategic Materials, 2012, Annual materials plan for FY 2013: Fort Belvoir, VA, DLA Strategic Materials news release, October 1, 1 p.
- EMC Metals Corp., 2012, Form 10-Q—September 30, 2012: U.S. Securities and Exchange Commission, 35 p.
- Fang, Jiyun, 2012, Update on the Chinese tungsten market: International Tungsten Industry Association Annual General Meeting, 25th, Beijing, China, September 18–20, presentation, 64 p.
- Gorbachev, Denis, 2013, Update on Russian tungsten market: International Tungsten Industry Association Annual General Meeting, 26th, Sydney, Australia, September 23–25, presentation, 22 p.
- Hack, Claire, 2013, Vietnam Youngsun Tungsten expects strong 2013 production: Metal Bulletin, no. 9292, March 4, p. 10.
- Hazelwood Resources Ltd., [undated], Cookes Creek Tungsten: Perth, Australia, Hazelwood Resources Ltd. (Accessed March 25, 2013, at http://www.hazelwood.com.au/Projects/Cookes_Creek_Tungsten/.)
- Hazelwood Resources Ltd., 2012, Ferrotungsten production startup status: Perth, Australia, Hazelwood Resources Ltd., December 7, 2 p.
- Japan Oil, Gas and Metals National Corp., 2011, Metals—JOGMEC's activities—Metal resources field: Tokyo, Japan, Japan Oil, Gas and Metals National Corp. brochure, May, 22 p.
- Journal of Turkish Weekly, The, 2012, Uzbekistan to begin developing tungsten deposit in 2013: The Journal of Turkish Weekly, October 30. (Accessed November 1, 2012, at <http://www.turkishweekly.net/news/144257/uzbekistan-to-begin-developing-tungsten-deposit-in-2013-.html>.)
- Kennametal Inc., 2012, Kennametal to invest in tungsten-cobalt blended powder operations in U.S. and China: Latrobe, PA, Kennametal Inc. press release, November 15, 1 p.
- King Island Scheelite Ltd., 2012, Report for the quarter ended 30 September 2012: Sydney, Australia, King Island Scheelite Ltd., October 31, 3 p.
- Largo Resources Ltd., 2012, Largo provides operational update: Toronto, Ontario, Canada, Largo Resources Ltd. press release, October 30, 2 p.
- Liu, Renfeng, 2013, China tungsten market update: International Tungsten Industry Association Annual General Meeting, 26th, Sydney, Australia, September 23–25, presentation, 45 p.

- Malaga Inc., 2013, Management discussion and analysis for the year ended December 31, 2012: Montreal, Quebec, Canada, Malaga Inc., March 28, 24 p.
- Masan Group Corp., 2013, 2012 annual report: Ho Chi Minh City, Vietnam, Masan Group Corp., 177 p.
- Masan Resources Corp., 2012, Nui Phao: Ho Chi Minh City, Vietnam, Masan Resources Corp. corporate presentation, April, 48 p.
- Metal Bulletin, 2013a, Making quick-mix ferro-tungsten: Metal Bulletin, no. 9301, May 8, p. 60, 62.
- Metal Bulletin, 2013b, Marketing quick-mix ferro-tungsten: Metal Bulletin, no. 9301, May 8, p. 62.
- Metal Bulletin, 2013c, Profile—Vietnam Youngsun Tungsten expects very good year in 2013: Metal Bulletin, no. 9292, March 4, p. 10.
- Metal-Pages, 2012, First phase of Brazil ferro-tungsten site launched [correction]: Metal-Pages, September 27. (Accessed December 10, 2012, via <http://www.metal-pages.com>.)
- Mining Magazine, 2012, Doing its bit for the environment: Mining Magazine, March. (Accessed March 15, 2012, via <http://www.miningmagazine.com>.)
- New York State Department of Environmental Conservation, 2012, Permit—Under the environmental conservation law: Buffalo, NY, New York State Department of Environmental Conservation, September 10, 31 p.
- North American Tungsten Corp. Ltd., 2013, Annual management discussion and analysis 2012: Vancouver, British Columbia, Canada, North American Tungsten Corp. Ltd., January 25, 25 p.
- Northcliff Resources Ltd., 2013, Northcliff releases positive feasibility study for Sisson tungsten-molybdenum project: Vancouver, British Columbia, Canada, Northcliff Resources Ltd. news release, January 29, 6 p.
- Office of the United States Trade Representative, [undated], Measures related to the exportation of rare earths, tungsten and molybdenum: Washington, DC, Office of the United States Trade Representative. (Accessed January 18, 2013, at <http://www.ustr.gov/trade-topics/enforcement/dispute-settlement-proceedings/wto-dispute-settlement/pending-wto-disputes-1>.)
- Ormonde Mining plc, 2013, Annual report & accounts 2012: Dublin, Ireland, Ormonde Mining plc, 57 p.
- Park, Sungwoo, 2011, Korea Resources to boost rare-metal reserves by 382% by 2016: Bloomberg Businessweek, December 6. (Accessed December 7, 2011, at <http://www.bloomberg.com/news/2011-12-06/korea-resources-to-boost-rare-metal-reserves-382-by-2016-1-.html>.)
- Ryan's Notes, 2012, Chinese raise W prices, but no buyers: Ryan's Notes, v. 18, no. 46, November 19, p. 2.
- Sandvik AB, 2013, Annual report 2012: Stockholm, Sweden, Sandvik AB, 108 p.
- Strizek, Mark, 2011, Explore develop deliver: Subiaco, Australia, Vital Metals Ltd. presentation, September, 29 p.
- Sumitomo Electric Industries, Ltd., 2013, Sumitomo Electric starts tungsten refining and scrap recycling operations in the United States: Osaka, Japan, Sumitomo Electric Industries, Ltd. press release, November 6. (Accessed November 12, 2013, at http://global-sei.com/news/press/13/prs119_s.html.)
- Tetra Tech WEI Inc., 2012, Sangdong project feasibility study: Swindon, United Kingdom, Tetra Tech WEI Inc., June 6, 25 individually paginated sections.
- Thor Mining PLC, 2012, Half-yearly report for the six months ended 31 December 2011: London, United Kingdom, Thor Mining PLC, March 9, 13 p.
- Thor Mining PLC, 2013, Half-yearly report for the six months ended 31 December 2012: London, United Kingdom, Thor Mining PLC, March 1, 17 p.
- Tinco Investments Ltd., [undated], Nyakabingo tungsten mine: London, United Kingdom, Tinco Investments Ltd. (Accessed November 29, 2012, at <http://www.tincogroup.com/nyakabingomine.php>.)
- Tungsten & Molybdenum Monthly, 2012, Tungsten guiding price in Nov. 2012: Tungsten & Molybdenum Monthly, no. 7, October, p. 17. (Also available via <http://www.antaik.com>.)
- Tungsten & Molybdenum Monthly, 2013a, Highlight: Tungsten & Molybdenum Monthly, no. 17, [September], p. 2. (Also available via <http://www.antaik.com>.)
- Tungsten & Molybdenum Monthly, 2013b, Tungsten—Market commentary: Tungsten & Molybdenum Monthly, no. 10, January, p. 3–8. (Also available via <http://www.antaik.com>.)
- Tungsten Industry—Conflict Minerals Council, [undated], Tungsten Industry—Conflict Minerals Council. (Accessed December 2, 2013, at <http://www.ti-cmc.org/>.)
- U.S. Department of Defense, 2013, Strategic and critical materials operations report to Congress—Operations under the Strategic and Critical Materials Stockpiling Act during fiscal year 2012: Fort Belvoir, VA, U.S. Department of Defense, January, 65 p.
- U.S. Securities and Exchange Commission, 2012, Conflict minerals—Final rule: Federal Register, v. 77, no. 177, September 12, p. 56,274–56,365.
- UzDaily, 2013, Uzbekistan increases production of metallic tungsten in 2012: UzDaily, February 4. (Accessed October 18, 2013, at <http://www.uzdaily.uz/articles-id-14341.htm>.)
- Venture Minerals Ltd., 2012, Bankable feasibility study delivers more than \$550 million in net revenue—Mt Lindsay tin/tungsten project: Subiaco, Australia, Venture Minerals Ltd. ASX announcement, November 7, 6 p.
- W Resources Plc, 2013, La Parrilla tailings project approved by the Spanish mining authorities—First production expected H2 2013: London, United Kingdom, W Resources Plc news release, January 22, 2 p.
- Wolf Minerals Ltd., 2013, Quarterly activities report—For the period ending 31st December 2012: Subiaco, Australia, Wolf Minerals Ltd. ASX announcement, January 31, 6 p.
- Woulfe Mining Corp., 2013, Management discussion and analysis for the three and six months ended December 31, 2012: Vancouver, British Columbia, Canada, Woulfe Mining Corp., March 1, 17 p.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

- Historical Statistics for Mineral and Material Commodities in the United States, Data Series 140.
- Tungsten. Ch. in Mineral Commodity Summaries, annual.
- Tungsten. Ch. in United States Mineral Resources, Professional Paper 820, 1973.
- Tungsten. International Strategic Mineral Issues Summary Report, Circular 930–O, 1998.
- Tungsten. Mineral Industry Surveys, monthly.
- Tungsten Recycling in the United States in 2000. Circular 1196–R, 2011.
- Tungsten (W). Ch. in Metal Prices in the United States Through 2010, Scientific Investigations Report 2012–5188, 2013.

Other

- Beijing Antaike Information Development Co., Ltd. Company reports and media releases.
- DATAWEB. U.S. International Trade Commission.
- DLA Strategic Materials, Defense Logistics Agency. Federal Register, daily.
- International Tungsten Industry Association.
- Materials Flow of Tungsten in the United States. U.S. Bureau of Mines Information Circular 9388, 1994.
- Metal Bulletin, daily, weekly, and monthly.
- Mining & Metals Report. Interfax International Ltd., weekly.
- Platts Metals Daily, daily.
- Roskill Information Services Ltd.
- Ryan's Notes, weekly.
- Strategic and Critical Materials Operations Report to the Congress. U.S. Department of Defense.
- Tungsten. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
- Tungsten. Mineral profile. British Geological Survey, 2011.
- Tungsten Industry of the U.S.S.R., The. U.S. Bureau of Mines Mineral Issues, 1988.

TABLE 1
SALIENT TUNGSTEN STATISTICS¹

(Metric tons, tungsten content and dollars per metric ton unit)

	2008	2009	2010	2011	2012
United States:					
Concentrates:					
Production	NA	NA	NA	NA	NA
Consumption	W	W	4,820	W	W
Exports	496	38	276	169	203
Imports for consumption	3,990	3,590	2,740	3,640	3,650
Stocks, December 31:					
Consumer	W	W	W	W	W
U.S. Government ²	19,700	19,000	17,000	15,800	14,000
Price:					
U.S. spot quotation ³	184	151	183	248	358
European ^{4,5}	164	150	150	150	XX
Ammonium paratungstate:					
Production	W	W	W	W	W
Consumption ⁶	9,700	6,860	10,300	W	W
Stocks, December 31, producer and consumer	W	100	62	W	W
Price:					
U.S. free market ^{4,7}	278	204	214	370	XX
U.S. market ³	260	178	186	397	449
European free market ⁴	249	203	244	431	386
Primary products:					
Net production ⁸	8,950	5,300	8,340	7,790	6,360
Consumption ⁹	12,100	7,460	10,900	12,200	11,300
Stocks, December 31:					
Producer ⁸	707	682	678	682	653
Consumer ⁹	571	509	567	558	708
U.S. Government ²	183	171	171	125	125
World, production of concentrate	61,900 ^r	61,200 ^r	68,500 ^r	73,900 ^r	75,700 ^e

^eEstimated. ^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.

¹Data are rounded to no more than three significant digits.

²Defense Logistics Agency, DLA Strategic Materials. Data are uncommitted material only.

³Annual average calculated from weekly prices reported by Platts Metals Week or Platts Metals Daily.

⁴Annual average calculated from semiweekly prices reported by Metal Bulletin.

⁵Price discontinued October 26, 2012.

⁶Reported by tungsten processors.

⁷Price discontinued July 18, 2012.

⁸Includes tungsten metal powder and tungsten carbide powder produced from metal powder; excludes cast and crystalline tungsten carbide powder and chemicals.

⁹Includes ammonium paratungstate and other tungsten chemicals, ferrotungsten, tungsten metal powder, tungsten carbide powder, and tungsten scrap.

TABLE 2
U.S. GOVERNMENT NATIONAL DEFENSE STOCKPILE TUNGSTEN STATISTICS IN 2012^{1,2}

(Metric tons, tungsten content)

Material	Inventory, yearend ³		Annual Materials Plan ⁵	Sales		Inventory decrease ⁴	
	Fiscal year ⁵	Calendar year		Fiscal year ⁵	Calendar year	Fiscal year ⁵	Calendar year
Ores and concentrates	14,200	14,000	3,630	1,610	1,820	1,610	1,780
Tungsten metal powder	121	125	136	39	4	39	(6)
Total	14,300	14,100	3,760	1,650	1,820	1,650	1,780

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes stockpile- and nonstockpile-grade materials.

³Uncommitted inventory only. Does not include material committed for sale pending shipment.

⁴From previous year. Based solely on uncommitted yearend inventories.

⁵Twelve-month period ending September 30, 2012.

⁶Less than ½ unit.

Source: Defense Logistics Agency, DLA Strategic Materials.

TABLE 3
U.S. NET PRODUCTION AND STOCKS OF TUNGSTEN PRODUCTS^{1,2,3}

(Metric tons, tungsten content)

	Tungsten metal powder	Tungsten carbide powder	Total
Net production:			
2011	3,330	4,460	7,790
2012	W	W	6,360
Producer stocks:			
December 31, 2011	273	410	682
December 31, 2012	300	353	653

W Withheld to avoid disclosing company proprietary data.

¹Net production equals receipts plus gross production less quantity used to make other products listed.

²Data are rounded to no more than three significant digits; may not add to totals shown.

³Data for cast and crystalline tungsten carbide powder and tungsten chemicals are withheld to avoid disclosing company proprietary data; not included in "Total."

TABLE 4
U.S. PROCESSORS OF TUNGSTEN IN 2012¹

Company	Plant location
ATI Alldyne ²	Huntsville, AL.
Buffalo Tungsten Inc.	Depew, NY.
Chem-Met Co., The	Clinton, MD.
Elmet Technologies, Inc.	Lewiston, ME.
General Electric Co.	Euclid, OH.
Global Tungsten & Powders Corp. ³	Towanda, PA.
Kennametal Inc.	Fallon, NV.
Do.	Latrobe, PA.
Tungsten Diversified Industries LLC ⁴	White Bear Lake, MN. ⁵
Do. Ditto.	

¹Consumers of ammonium paratungstate, tungsten-bearing scrap, tungsten concentrates, and (or) tungsten oxides.

²An Allegheny Technologies Inc. company.

³A division of Plansee Group.

⁴Joint venture of North American Tungsten Corp. Ltd., Tundra Particle Technologies LLC, and Queenwood Capital Partners LLC.

⁵Pilot-scale operation.

TABLE 5
U.S. REPORTED CONSUMPTION AND STOCKS OF TUNGSTEN PRODUCTS^{1,2,3}

(Metric tons, tungsten content)

	2011	2012
Consumption by end use:		
Steels	96	123
Superalloys	997	580
Other alloys ⁴	W	W
Cemented carbides ⁵	6,760	6,800
Mill products made from metal powder	W	W
Chemical	88	88
Total	12,200	11,300
Consumption by form:		
Ferrotungsten	115	165
Tungsten metal powder	W	W
Tungsten carbide powder	6,850	6,950
Tungsten scrap ⁶	W	W
Other tungsten materials ⁷	88	88
Total	12,200	11,300
Consumer stocks, December 31:		
Ferrotungsten	18	W
Tungsten metal powder	36	40
Tungsten carbide powder	445	471
Tungsten scrap ⁶	45	W
Other tungsten materials ⁷	13	13
Total	558	708

W Withheld to avoid disclosing company proprietary data; included in "Total."

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Does not include materials used in making primary tungsten products.

³Includes estimates.

⁴Includes welding and hard-facing rods and materials, wear- and corrosion-resistant alloys, and nonferrous alloys.

⁵Includes diamond tool matrices, cemented and sintered carbides, and cast carbide dies or parts.

⁶Includes tungsten bars.

⁷Includes tungsten chemicals.

TABLE 6
U.S. EXPORTS OF TUNGSTEN ORES AND CONCENTRATES, BY COUNTRY¹

Country of destination	2011			2012		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Tungsten content ² (metric tons)		Gross weight (metric tons)	Tungsten content ² (metric tons)	
Australia	--	--	--	2	1	\$38
Brazil	39	20	\$609	15	8	259
Canada	--	--	--	7	3	110
China	190	98	3,720	299	154	2,480
Germany	--	--	--	7	4	114
India	3	2	98	--	--	--
Japan	--	--	--	33	17	441
Malaysia	3	2	46	(3)	(3)	7
Netherlands	60	31	1,140	--	--	--
Taiwan	18	9	278	--	--	--
Vietnam	13	7	198	30	15	348
Other	2 ^r	1	49 ^r	(3)	(3)	9
Total	328	169	6,140	394	203	3,800

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Content estimated from reported gross weight.

³Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 7
U.S. EXPORTS OF AMMONIUM PARATUNGSTATE, BY COUNTRY^{1,2}

Country of destination	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Belgium	26	\$557	1	\$9
Finland	1	5	--	--
Germany	566	11,200	534	10,600
Hungary	152	1,730	51	820
India	4	34	20	180
Italy	(3)	8	1	19
Japan	23	335	--	--
Mexico	3	28	--	--
Switzerland	202	4,770	224	4,820
Taiwan	(3)	11	(3)	6
United Kingdom	(3)	5	2	16
Total	977	18,700	833	16,500

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes other ammonium tungstates, such as ammonium metatungstate.

³Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 8
U.S. EXPORTS OF TUNGSTEN METAL POWDERS, BY COUNTRY^{1,2}

Country of destination	2011			2012		
	Quantity		Value (thousands)	Quantity		Value (thousands)
	Gross weight (metric tons)	Tungsten content ³ (metric tons)		Gross weight (metric tons)	Tungsten content ³ (metric tons)	
Argentina	3	2	\$195	6	5	\$280
Australia	3	2	175	8	7	348
Austria	63	50	3,100	25	20	1,260
Brazil	19	15	1,120	19	16	1,080
Canada	151	121	9,690	149	119	9,630
Chile	10	8	720	6	5	355
China	40	32	2,870	26	21	2,260
Colombia	5	4	281	2	2	114
France	34	27	1,590	2	2	150
Germany	176	141	13,500	156	125	13,400
Hong Kong	3	3	125	1	(4)	31
India	20	16	1,550	32	26	2,300
Ireland	(4)	(4)	4	10	8	414
Israel	4	3	217	10	8	530
Japan	13	10	979	23	19	1,990
Korea, Republic of	21	16	1,070	10	8	581
Mexico	31	25	1,490	12	9	813
Norway	--	--	--	2	2	80
Peru	19	16	1,310	1	1	94
Saudi Arabia	114	91	4,830	197	157	7,480
Singapore	22	18	1,620	26	21	1,630
South Africa	21	17	1,820	5	4	404
Sweden	(4)	(4)	8	4	3	277
Switzerland	12	10	1,040	--	--	--
Taiwan	31	25	2,440	36	29	3,300
Thailand	2	2	98	(4)	(4)	37
Turkey	17	14	1,000	15	12	978
United Arab Emirates	4	3	284	1	1	53
United Kingdom	6	5	323	5	4	297
Venezuela	4	3	284	(4)	(4)	40
Other	9 ^r	7 ^r	620 ^r	6	5	583
Total	857	686	54,300	797	637	50,800

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²May include tungsten alloy powders.

³Content estimated from reported gross weight.

⁴Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 9
U.S. EXPORTS OF TUNGSTEN CARBIDE POWDER, BY COUNTRY¹

Country of destination	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Australia	26	\$819	11	\$607
Austria	169	5,950	79	1,910
Belgium	2	196	1	70
Brazil	13	431	17	824
Canada	127	6,730	96	5,730
Chile	1	138	2	114
China	31	1,900	54	2,810
Colombia	(2)	19	5	156
Czech Republic	3	137	(2)	26
Denmark	6	280	6	262
Ecuador	2	58	2	114
France	20	1,070	5	212
Germany	213	11,600	125	9,500
Hong Kong	7	600	3	171
India	5	275	2	152
Indonesia	5	267	3	164
Ireland	2	189	20	1,200
Israel	14	189	8	172
Italy	12	1,000	13	647
Japan	41	1,020	28	1,400
Korea, Republic of	6	336	7	616
Luxembourg	--	--	2	36
Mexico	8	474	19	1,860
Netherlands	4	145	2	58
Peru	8	483	9	552
Poland	(2)	43	3	119
Saudi Arabia	15	870	5	138
Singapore	6	411	6	643
South Africa	16	952	8	442
Sweden	41	1,610	33	2,080
Switzerland	5	357	3	275
Taiwan	60	3,720	67	4,380
Thailand	3	213	1	65
United Kingdom	357	18,700	197	13,400
Venezuela	20	915	32	1,580
Other	9 ^r	850 ^r	5	327
Total	1,250	63,000	878	52,800

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 10
U.S. EXPORTS OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY¹

Product and country of destination	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Ferrotungsten and ferrosilicon tungsten:				
Belgium	8	\$133	--	--
Mexico	1	5	1	\$11
Netherlands	11	586	--	--
United Kingdom	2	5	(2)	21
Total	22	730	2	32
Unwrought tungsten:^{3,4,5}				
Australia	4	18	--	--
Austria	17	72	43	886
Belgium	86	361	9	32
Brazil	14	65	46	366
Canada	488	2,240	609	2,710
China	7	30	24	100
France	30	124	39	166
Germany	50	212	13	57
Hong Kong	--	--	13	54
Hungary	9	40	2	9
India	--	--	10	44
Indonesia	33	139	72	328
Japan	103	435	36	151
Korea, Republic of	5	19	2	8
Luxembourg	6	24	--	--
Malaysia	6	27	7	29
Mexico	76	323	72	318
Netherlands	--	--	15	319
Panama	--	--	12	53
Philippines	15	64	--	--
Singapore	38	164	94	406
Switzerland	--	--	19	78
Taiwan	37	163	11	45
Thailand	1	8	27	114
Turkey	24	100	51	216
United Kingdom	9	38	39	328
Vietnam	--	--	12	32
Other	12 ^r	49 ^r	13	67
Total	1,070	4,720	1,290	6,920
Waste and scrap:⁴				
Australia	--	--	47	401
Austria	10	87	--	--
Belgium	154	1,300	--	--
Brazil	7	108	13	121
Canada	132	1,190	120	1,160
China	291	2,460	31	552
Czech Republic	25	702	172	5,550
Finland	892	7,580	534	4,520
France	12	99	--	--
Germany	492	7,230	194	2,090
Hong Kong	9	109	24	334
Hungary	9	75	1	11
India	4	70	23	214
Israel	42	687	167	1,410
Japan	142	1,200	515	4,350
Malaysia	2	15	10	91
Sweden	319	2,700	249	2,400
Taiwan	7	61	13	107

See footnotes at end of table.

TABLE 10—Continued
 U.S. EXPORTS OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS, BY COUNTRY¹

Product and country of destination	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Waste and scrap:⁴—Continued				
United Kingdom	92	\$1,430	414	\$3,640
Vietnam	--	--	92	776
Other	15 ^r	134 ^r	10	115
Total	2,660	27,200	2,630	27,800
Wrought tungsten:^{3,4,6}				
Austria	(2)	19	10	948
Belgium	5	661	(2)	40
Brazil	7	517	4	706
Canada	41	5,030	28	3,660
China	6	1,270	16	1,960
Costa Rica	13	1,650	14	1,810
Czech Republic	23	2,840	17	2,140
France	5	371	1	267
Germany	68	7,700	45	5,600
Hungary	2	319	3	457
India	24	2,390	28	4,530
Israel	1	113	4	512
Italy	1	269	3	421
Japan	34	7,990	13	2,460
Korea, Republic of	2	621	3	821
Malaysia	2	444	(2)	69
Mexico	14	2,480	27	3,570
Russia	1	122	3	282
Singapore	7	1,290	10	1,440
Sweden	4	580	1	116
Taiwan	2	420	1	285
United Kingdom	19	2,270	5	1,110
Venezuela	1	78	2	182
Other	8 ^r	1,560 ^r	9	2,010
Total	289	41,000	246	35,400
Tungsten compounds:⁷				
Canada	3	9	5	19
China	1	19	3	38
Germany	3	112	--	--
Malaysia	--	--	2	19
Other	(2)	25	(2)	11
Total	7	165	10	88

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than ½ unit.

³May include alloys.

⁴Content estimated from reported gross weight.

⁵Includes bars and rods produced simply by sintering; excludes powders and waste and scrap.

⁶Includes bars and rods other than those produced simply by sintering; profiles, plates, sheets, strip, and foil; wire; and other wrought products.

⁷Includes only other tungstates.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION OF TUNGSTEN ORES AND CONCENTRATES,
BY COUNTRY¹

Country of origin	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Australia	--	--	22	\$852
Bolivia	866	\$21,200	1,160	44,600
Brazil	52	1,680	138	4,120
Canada	110	3,620	345	10,700
Chile	14	460	13	439
China	49	789	14	483
Colombia	--	--	120	4,000
France	--	--	(2)	2
Germany	1	32	38	1,230
Israel	--	--	23	364
Mexico	5	84	18	310
Mongolia	230	6,410	40	2,980
Peru	429	17,900	293	11,600
Portugal	522	21,200	656	27,900
Russia	--	--	18	727
Rwanda	11	194	11	428
Spain	481	18,800	547	21,400
Thailand	91	3,290	87	3,750
Uganda	20	422	--	--
United Kingdom	12	471	53	1,530
Vietnam	750	22,000	46	1,380
Total	3,640	119,000	3,650	139,000

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 12
U.S. IMPORTS FOR CONSUMPTION OF AMMONIUM PARATUNGSTATE, BY COUNTRY^{1,2}

Country of origin	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
China	1,890	\$72,700	1,410	\$52,700
Germany	113	4,020	89	3,600
Japan	(3)	41	--	--
United Kingdom	--	--	(3)	2
Vietnam	22	939	--	--
Total	2,020	77,700	1,500	56,300

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes other ammonium tungstates, such as ammonium metatungstate.

³Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 13
 U.S. IMPORTS FOR CONSUMPTION OF FERROTUNGSTEN AND
 FERROSILICON TUNGSTEN, BY COUNTRY¹

Country of origin	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
China	184	\$6,950	131	\$5,860
Germany	--	--	8	369
Netherlands	--	--	2	121
Vietnam	22	1,020	175	7,820
Total	206	7,980	316	14,200

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 14
U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS,
BY COUNTRY¹

Product and country of origin	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Tungsten metal powders:²				
Canada	182	\$8,950	111	\$7,670
China	292	15,700	358	20,700
Finland	(3)	3	3	130
Germany	203	11,000	175	12,400
Hong Kong	13	746	--	--
Israel	235	14,300	179	12,600
Japan	92	5,910	17	1,700
Korea, Republic of	311	19,100	322	20,700
Mexico	7	162	--	--
Singapore	15	1,050	53	3,910
United Kingdom	3	166	3	76
Vietnam	20	1,020	7	535
Other	1 ^r	153 ^r	2	202
Total	1,370	78,200	1,230	80,600
Tungsten carbide powder:				
Austria	48	3,030	67	4,020
Belgium	32	1,700	26	1,090
Canada	246	13,500	82	5,770
China	654	40,000	822	54,900
Czech Republic	51	4,890	--	--
Finland	4	214	--	--
France	8	563	10	916
Germany	166	15,400	135	12,200
Hong Kong	8	587	2	209
India	7	508	1	61
Israel	75	4,320	31	2,180
Japan	31	1,130	9	291
Korea, Republic of	18	1,260	19	1,460
Luxembourg	--	--	12	1,230
Netherlands	3	203	2	10
Vietnam	333	22,200	16	1,250
Other	2 ^r	133 ^r	2	171
Total	1,690	110,000	1,240	85,700
Unwrought tungsten:^{2,4,5}				
Austria	3	75	2	144
China	296	14,500	327	16,200
Germany	2	301	2	251
Hong Kong	--	--	8	406
Singapore	4	263	1	91
Sweden	5	280	--	--
United Kingdom	5	359	7	174
Vietnam	18	619	3	144
Other	1	65	2	280
Total	334	16,500	351	17,700
Waste and scrap:				
Austria	103	2,590	212	3,340
Canada	30	708	30	875
China	217	9,440	66	3,220
Croatia	20	838	--	--
Czech Republic	14	541	35	1,240
Germany	123	2,240	187	5,040
Hong Kong	12	628	17	647
India	156	5,170	143	4,330

See footnotes at end of table.

TABLE 14—Continued
 U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS,
 BY COUNTRY¹

Product and country of origin	2011		2012	
	Quantity, tungsten content (metric tons)	Value (thousands)	Quantity, tungsten content (metric tons)	Value (thousands)
Waste and scrap:—Continued				
Israel	12	\$402	41	\$1,340
Japan	74	2,060	13	290
Korea, Republic of	163	3,990	101	2,230
Luxembourg	46	627	184	5,370
Mexico	203	3,510	251	4,880
Pakistan	--	--	17	645
Singapore	22	281	19	307
South Africa	--	--	37	1,100
Sweden	39	956	69	2,120
Thailand	18	442	--	--
United Kingdom	85	3,070	42	1,740
Other	29 ^r	856 ^r	33	1,150
Total	1,370	38,300	1,500	39,900
Wrought tungsten^{2, 4, 6}				
Austria	91	18,000	56	9,940
China	559	35,700	523	32,300
France	7	1,340	4	1,040
Germany	23	3,600	17	3,270
Hong Kong	3	376	3	294
Hungary	6	1,090	8	1,880
Japan	19	5,360	20	5,480
Luxembourg	4	536	4	93
Russia	20	2,270	13	1,470
Singapore	13	2,050	24	3,250
South Africa	6	228	1	29
United Kingdom	3	1,040	2	682
Other	7 ^r	3,000 ^r	9	2,480
Total	762	74,600	682	62,200
Tungsten oxides:				
Belgium	--	--	1	35
China	1,540	73,300	1,150	55,700
Czech Republic	12	696	--	--
Germany	4	147	10	415
Hong Kong	--	--	8	385
Japan	39	1,720	--	--
Russia	99	6,840	--	--
United Kingdom	2	160	--	--
Vietnam	115	5,420	31	1,510
Total	1,810	88,300	1,200	58,000
Other tungstates:				
China	12 ^r	779	15	741
Germany	3	234	9	219
India	16	541	7	293
Other	(3)	38	1	40
Total	31	1,590	32	1,290
Other tungsten compounds:⁷				
China	1	93	--	--
Germany	2	324	(3)	192
Japan	5	1,530	7	2,270
Russia	2	86	(3)	79
Total	10	2,040	7	2,540

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 14—Continued
U.S. IMPORTS FOR CONSUMPTION OF MISCELLANEOUS TUNGSTEN-BEARING MATERIALS,
BY COUNTRY¹

²May include alloys.

³Less than ½ unit.

⁴Content estimated from reported gross weight.

⁵Includes bars and rods produced simply by sintering; excludes powders and waste and scrap.

⁶Includes bars and rods other than those produced simply by sintering; foil, plates, profiles, sheets, and strip; wire; and other wrought products.

⁷Includes tungsten chlorides.

Source: U.S. Census Bureau.

TABLE 15
TUNGSTEN: WORLD CONCENTRATE PRODUCTION, BY COUNTRY^{1,2}

(Metric tons, tungsten content)

Country ³	2008	2009	2010	2011	2012 ^c
Australia	28	33	16	15	80
Austria	1,122	887	977	706 ^r	800
Bolivia	1,148	1,023	1,204	1,124	1,270
Brazil	408	192	166	300 ^r	300 ^p
Burma ⁴	136	87	163	140 ^{r,c}	140
Burundi	125	79	107	160 ^r	160
Canada	2,277	1,964	420	1,967	2,194 ^{p,5}
China ^{e,6}	50,000	51,000	59,000	61,800	64,000
Congo (Kinshasa) ^{e,7}	370	200	25	70 ^r	95
Korea, North ^{e,8}	270	100	110	110	100
Mongolia	142	39	20	13	--
Peru ⁹	456	502	571	439	276 ⁵
Portugal	982	823	799	819	763 ⁵
Russia	3,163 ^r	2,665 ^r	2,785 ^r	3,314 ^r	3,000
Rwanda	670	450	390	640 ^r	830
Spain	150 ^e	200 ^e	229	497	542 ⁵
Thailand ^{e,10}	420 ^r	190 ^r	300 ^r	160 ^r	80 ⁵
Uganda	48 ^r	7 ^r	44 ^r	8 ^r	21 ⁵
United States	NA	NA	NA	NA	NA
Vietnam ¹¹	--	725	1,150	1,635	1,050 ⁵
Total	61,900 ^r	61,200 ^r	68,500 ^r	73,900 ^r	75,700

^cEstimated. ^pPreliminary. ^rRevised. NA Not available. -- Zero.

¹World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through February 21, 2014.

³Tungsten concentrates are thought to be produced in Colombia, Mexico, and Nigeria, and may be produced from tin-tungsten ores in Kyrgyzstan, but information is inadequate to make reliable estimates of production. Illegal tungsten (wolfram) mining in the Phuoc Trung Commune of the Bac Ai District, Ninh Thuan Province in Southern Vietnam reportedly was halted by the District People's Committee in April 2008.

⁴Includes tungsten content of tin-tungsten concentrate produced by state-owned mining enterprises under the Ministry of Mines.

⁵Reported figure.

⁶Based upon data published in the Yearbook of Nonferrous Metals Industry of China.

⁷Production estimated based on reported exports from Nord-Kivu and Sud-Kivu Provinces.

⁸Production estimated based on Chinese imports.

⁹Data based on production reported by Malaga Inc.

¹⁰Based upon data from the Department of Primary Industries and Mines.

¹¹Mine production reported by the International Tungsten Industry Association.